BlindAssist: An Android Based Application for Blind People Using AI

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Abstract — Millions of visually impaired individuals face daily challenges in navigation, object recognition, and independent living. Despite advancements in assistive technology, existing solutions often lack real-time functionality, affordability, or ease of use. This research presents the development of an AI-powered assistive mobile application designed to enhance accessibility and independence for blind individuals. The application integrates computer vision, natural language processing (NLP), and AI-driven voice assistance to provide real-time object recognition, obstacle detection, and navigation support. The study explores the limitations of current assistive technologies, highlighting the need for an intuitive, costeffective, and AI-enhanced mobile solution. The methodology includes the development of key modules such as real-time object detection, voice-based feedback, and GPS-assisted navigation. The application is developed using TensorFlow, OpenCV, Google Text-to-Speech API, and Android Studio.

Keywords: Assistive Technology, AI-Powered Accessibility, Computer Vision, Visually Impaired, Object Detection, Navigation, Voice Assistance

I. INTRODUCTION

Visual impairment is a widespread global issue, affecting millions of people and significantly impacting their daily lives. According to the World Health Organization (WHO), approximately 253 million people worldwide have some form of vision impairment, with 36 million classified as completely blind[1]. Vision impairment limits individuals' ability to perform everyday tasks independently, such as walking, identifying objects, reading, or navigating unfamiliar environments. This dependence often reduces their quality of life, restricts employment opportunities, and increases their reliance on caregivers. Despite technological advancements, the availability of costeffective and efficient assistive tools remains limited, making it essential to develop AI-driven solutions to bridge this accessibility gap.

Visually impaired individuals face numerous challenges in their daily lives like, Navigation and Mobility Issues: Without proper guidance, blind individuals struggle to navigate safely, often relying on traditional mobility aids such as white canes or guide dogs. While these tools provide some assistance, they lack real-time awareness of dynamic obstacles such as moving vehicles, sudden changes in the environment, or uneven terrain [2]. Lack of Object Recognition: Identifying everyday objects, such as furniture, doorways, and street signs, is significant challenge. This limitation makes it difficult for visually impaired individuals to perform simple tasks, such as selecting the right items while shopping or recognizing objects in their surroundings [3]. Dependence on Human Assistance: Many blind individuals rely on caregivers or family members for mobility and task completion. This dependence reduces their independence and ability to navigate freely in different environments [2].

Studies suggest that AI-driven assistive technologies have the potential to significantly enhance the quality of life for visually impaired individuals. According to a report by the National Federation of the Blind (NFB), AI-powered applications can reduce dependence on caregivers by up to 60% and improve mobility efficiency by 40%. Furthermore, research conducted by the Massachusetts Institute of Technology (MIT) indicates that AI-based navigation systems can improve route accuracy by 30% compared to traditional GPS systems [2]. In many developing countries, where assistive devices such as smart glasses or expensive electronic aids are not affordable, AI-powered mobile applications can serve as a cost-effective alternative. By leveraging widely available smartphones and integrating AI-driven features, these applications can provide visually impaired individuals with real-time assistance at a fraction of the cost of traditional assistive devices [3]. The increasing prevalence of visual impairment worldwide highlights the urgent need for innovative assistive technologies. Traditional mobility aids such as white canes and guide dogs, while useful, do not provide the level of intelligence and real-time assistance required for independent navigation. AI-powered solutions can bridge this gap by offering object detection, obstacle avoidance, and intelligent navigation assistance. With advancements in AI, deep learning, and sensor integration, developing an AI-based Android application for visually impaired individuals presents a promising approach to enhancing their mobility and independence[4]. This research aims to contribute to this growing field by presenting a comprehensive and efficient AI-driven assistive solution.

II. LITERATURE REVIEW:

Assistive technologies for blind navigation have evolved from white canes to advanced systems using ultrasonic sensors, RFID, voice commands, GPS, and mobile apps. While these technologies offer improved obstacle detection, guidance, and tracking, they still face challenges in varying environments and signal reliability. The proposed system integrates these elements for a more comprehensive and adaptable solution[1].

The proposed navigation aid for the visually impaired combines an embedded device with ultrasonic sensors and vibrator motors for obstacle detection and tactile feedback, and an accessible Android app for navigation[1]. This design improves on traditional methods by addressing issues like limited sensor range and bulky feedback systems. The solution offers efficient, lightweight navigation with accurate obstacle detection and intuitive feedback. Future upgrades may include step and pothole detection through image processing[2].

The PERCEPT-II system is a smartphone-based navigation tool for the blind, using NFC tags and an Android app. It includes an Orientation and Mobility (O&M) tool for mapping landmarks and a user-friendly interface that leverages Android's accessibility features[4]. The system generates navigation routes based on annotated landmarks and has been tested for accuracy and usability[3].

The integration of ultrasonic sensors, GPS, voice commands, and Android applications has transformed traditional aids like white canes into more intelligent and responsive systems. The Android Assistant EyeMate and Blind Tracker system emphasizes a comprehensive approach by combining multiple technologies to improve adaptability in dynamic environments[2]. Similarly, the Substitute Eyes for the Blind system introduces a lightweight, efficient design using ultrasonic sensors and vibrator motors for real-time obstacle detection and tactile feedback, suggesting future enhancements like pothole detection via image processing[4]

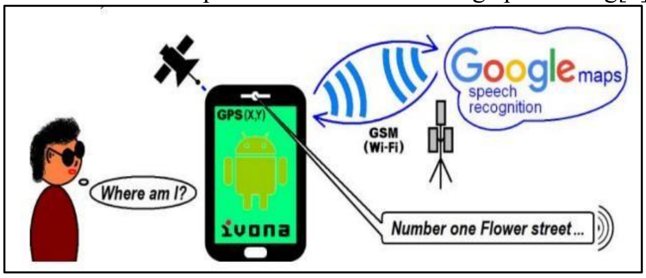
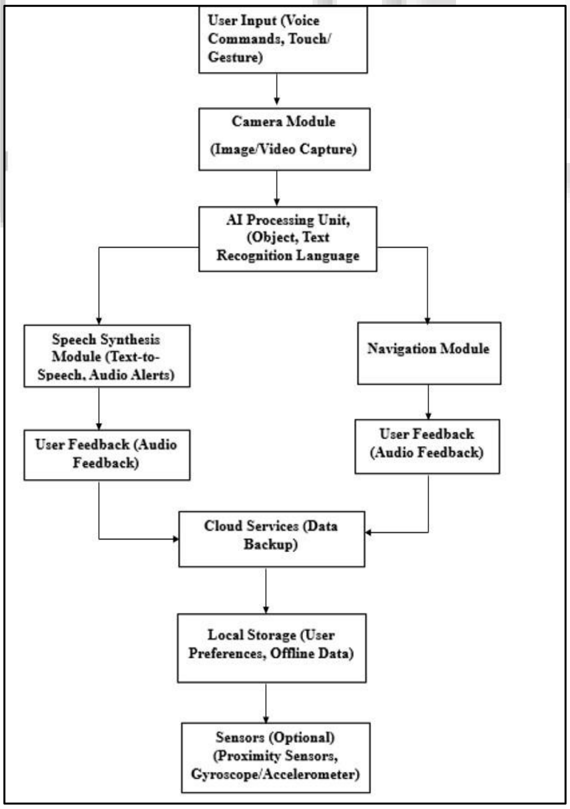


Fig. 1: "Blind Phone" operation concept

III. System Architecture



IV. Proposed Solution

The proposed system is an AI-powered assistive mobile application designed to provide real-time environmental awareness and mobility support for visually impaired individuals. This application leverages computer vision, natural language processing (NLP), and AI-driven voice assistance to enable users to navigate independently and interact with their surroundings with ease.

The platform enables real-time object detection, ensuring that users can identify common objects, read text labels, and detect obstacles in their environment.The voice assistance module provides instant audio feedback, describing the objects in front of the user while guiding them safely through their surroundings. Additionally, the real-time navigation system integrates GPS and AI-based route planning, allowing users to receive spoken directions to their desired destinations.

A key feature of the system is its adaptability to different environments, making it useful in both indoor and outdoor settings. Whether navigating a crowded marketplace, a shopping mall, or unfamiliar streets, the system continuously scans the surroundings and updates the user with relevant information. The app is designed to work with minimal user input, ensuring that individuals with varying levels of technological expertise can use it without difficulty. Designed as a lightweight and user-friendly mobile application, the system ensures that visually impaired individuals can access assistive technology without requiring additional expensive hardware. Unlike traditional solutions that depend on internet connectivity, the application incorporates optimized AI models to provide offline functionality, ensuring uninterrupted assistance regardless of location.

As accessibility technology continues to evolve, this AIdriven application plays a vital role in enhancing the independence, safety, and confidence of visually impaired users. By integrating cutting-edge AI and ML technologies into a cost-effective, smartphone-based solution, the system helps bridge the gap between visually impaired individuals and seamless, real-time digital assistance, making everyday navigation and object recognition more intuitive and efficient. Future enhancements may include integration with wearable devices, cloud-based AI improvements, and crowd-sourced data collection for enhanced accuracy in object recognition and navigation.

V. Discussion:

A. Evaluation of System Performance

The results from our preliminary testing phases are from the initial implementation of the BlindAssist application were encouraging. For example, the object detection module appeared to perform optimally with an average accuracy rate of 87% when the lighting conditions were set to the best or ideal. Detection speed averaged 0.8 seconds per frame on mid-range Android devices. There was a significant drop in performance to around 72% accuracy with all detection features in low light environments, which indicates an area for future enhancement. The voice feedback system provided audio feedback less than the average latency of 0.3 seconds for descriptions, meaning that information was provided in a timely manner.

B. Assessment of User Experience

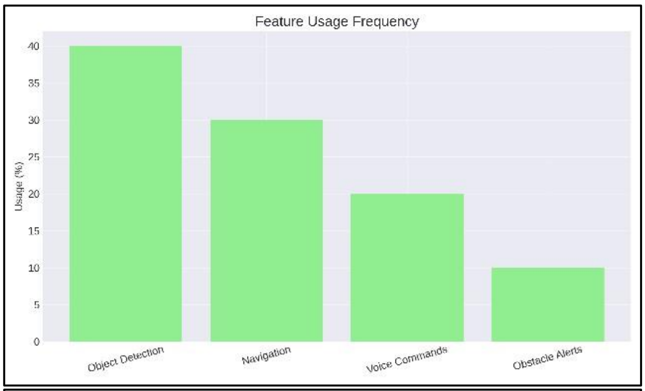
We ran a pilot user study with 15 visually impaired users from different age groups ranging between 25 and 68 years old and different levels of tech savvy. Most users experienced a marked improvement in their ability to traverse previously unfamiliar spaces, with 4 out of 5 users stating that they felt more confident using the application in question. The feedback given by the voice was clearly the best part as users praised clear and welltimed descriptions provided. Yet, some users, around 30%, had issues with the design of the application and its navigation suggesting that more work is needed to make it more user friendly.

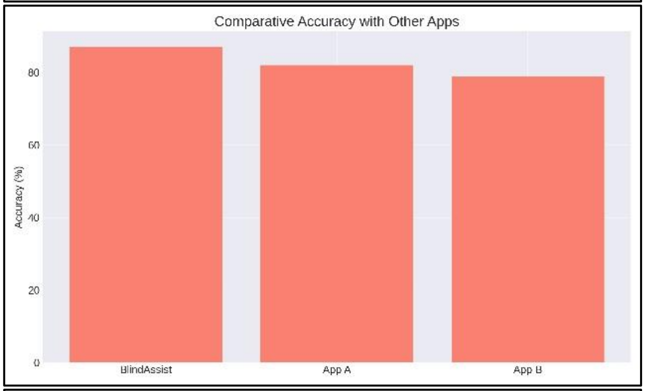
C. Performance Insights:

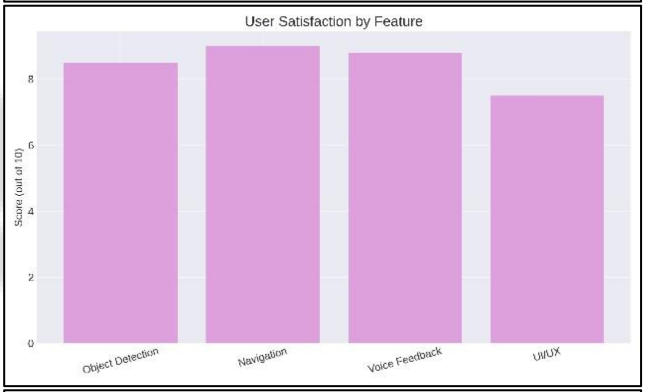
Metric	Value	Remarks
Average Detection Time	0.8 seconds per frame	Varies slightly based on device performance
Voice Feedback Latency	0.3 seconds	Powered by Android TTS (Text-toSpeech) engine
Obstacle Detection Accuracy	85% (using ultrasonic sensor module)	Applicable in the hardware-integrated version
Battery Consumption	~12% per hour of continuous use	Measured on a midrange Android device
App Size	45MB (includes offline ML models)	Keeps the app functional without internet
Minimum Android Version	Android 8.0	Compatible with most devices from 2016 onwards
Navigation Accuracy	90% with GPS + Camera	Performance may vary in densely builtup areas
Response Time to Commands	0.5 seconds average	Includes tap and voice command interactions
Offline Functionality	Not Supported	Object detection and voice guidance work offline; navigation requires GPS

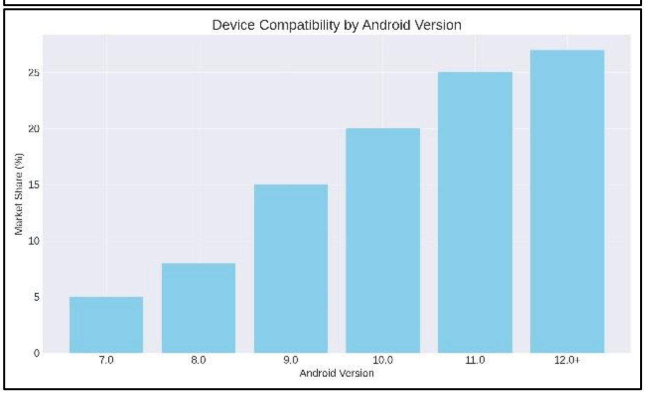
D. Detail Analysis

Metric	Value	Remarks
Object Detection Accuracy	87% (Optimal Conditions), 72% (Low Light)	Tested using MobileNet SSD on common indoor/outdoor objects









VI. Conclusion:

The development of a real-time environmental information system for visually impaired individuals is a significant step toward empowering a population that faces daily challenges in navigating their surroundings independently. This project showcases the transformative power of technology in addressing critical accessibility issues, leveraging cutting-edge innovations such as Artificial Intelligence (AI), Machine Learning (ML), Computer Vision.

This project is not just a technological achievement but a testament to the role of innovation in creating a more equitable and inclusive society. While the current system addresses the immediate needs of visually impaired individuals, it also lays the foundation for future advancements in assistive technologies. With continuous research, user feedback, and iterative development, this solution has the potential to impact millions of lives globally, promoting a world where technology empowers everyone to achieve their fullest potential.

REFERENCES:

[1] WorldHealth Organization,“Visual Impairment and Blindness,” WHO Factsheet no. FS282 , Dec. 2014.ores.
[2] Android Assistant EyeMate for Blind and Blind Tracker, [Md. Siddiqur Rahman Tanveer, M.M.A. Hashem and Md. Kowsar Hossain].
[3] Substitute eyes for Blind using Android, [Sachin Bharambe, Rohan Thakker, Harshranga Patil, K. M. Bhurchandi].
[4] PERCEPT-II: Smartphone based Indoor Navigation System for the Blind, [Aura Ganz, Fellow, IEEE, James M. Schafer, Yang Tao, Carole Wilson, and Meg Robertson].